What is claimed is:

1. A stage assembly for positioning a device, the stage assembly comprising:

a stage;

a mover assembly that moves the stage, the mover assembly including an attraction-only type first actuator, the first actuator including a first target and a first electromagnet that is spaced apart from the first target, the first target having a first target surface that generally faces the first electromagnet, the first electromagnet being positioned at a first angle having an absolute value of greater than zero relative to the first target surface; and

a control system that directs a first current to the first actuator based on the first angle.

2. The stage assembly of claim 1 wherein the first electromagnet includes an E core and the first target includes an I core.

3. The stage assembly of claim 1 wherein the first electromagnet includes a first measurement point that spaced apart a first physical gap g_1 from the first target surface, and a spaced apart second measurement point that is spaced apart a first functional gap $\bar{g}_1$ from the first target surface, g_1 being different than the $\bar{g}_1$, and wherein the control system directs the first current to the first actuator based on g_1 and $\bar{g}_1$.

4. The stage assembly of claim 3 wherein the control system directs the first current to the first actuator based on the difference between g_1 and $\bar{g}_1$.

5. The stage assembly of claim 1 wherein the first current directed to the first actuator is calculated using the formula:

$$I_1 = \sqrt{\frac{[(g_o - \bar{x}) + a][(g_o - \bar{x}) + b]}{(g_o + a)(g_o + b)} \frac{F_1}{k}},$$

where g_o is the nominal operating E-I gap, a is a first parameter, b is a second parameter, k is an E-I force constant, F_1 is a first desired force to be imposed on the stage, and $\bar{x}$ is the difference between a centerline of the stage and a functional range midpoint of the stage.

6. The stage assembly of claim 1 wherein the mover assembly includes an attraction-only type second actuator that cooperates with the first actuator to move the stage, the second actuator including a second target and a second electromagnet that is spaced apart from the second target, the second target having a second target surface that generally faces the second electromagnet, the second electromagnet being positioned at a second angle relative to the second target surface, wherein the control system directs a second current to the second actuator based on the second angle.

7. The stage assembly of claim 6 wherein the first actuator imposes a first force on the stage that is at least partially opposed by a second force imposed on the stage by the second actuator.

8. The stage assembly of claim 6 wherein the first actuator and the second actuator form an actuator pair.

9. The stage assembly of claim 6 wherein the first electromagnet includes an E core and the first target includes an I core.

10. The stage assembly of claim 9 wherein the second electromagnet includes an E core and the second target includes an I core.

11. The stage assembly of claim 6 wherein the second electromagnet includes a first measurement point that is spaced apart from the second target surface by a second physical gap g_2, and a spaced apart second measurement point that is spaced apart from the second target surface by a second functional

gap $\bar{g}_2$, g_2 being different than $\bar{g}_2$, and wherein the control system directs the second current to the second actuator based on g_2 and $\bar{g}_2$.

12. The stage assembly of claim 11 wherein the first electromagnet includes a first measurement point that spaced apart a first physical gap g_1 from the first target surface, and a spaced apart second measurement point that is spaced apart a first functional gap $\bar{g}_1$ from the first target surface, g_1 being different than the $\bar{g}_1$, and wherein the control system directs the first current to the first actuator based on g_1 and $\bar{g}_1$.

13. The stage assembly of claim 11 wherein the control system directs the second current to the second actuator based on the difference between the g_2 and $\bar{g}_2$.

14. The stage assembly of claim 6 wherein the first angle is different than the second angle.

15. The stage assembly of claim 14 wherein the control system directs current to at least one of the actuators based on the difference between the first angle and the second angle.

16. The stage assembly of claim 14 wherein the control system directs current to each of the actuators based on the difference between the first angle and the second angle.

17. An exposure apparatus including an illumination source and the stage assembly of claim 1 positioned near the illumination source.

18. A device manufactured with the exposure apparatus according to claim 17.

19. A wafer on which an image has been formed by the exposure apparatus of claim 17.

20. A stage assembly for positioning a device, the stage assembly comprising:

a stage;

a mover assembly that moves the stage, the mover assembly including an attraction-only type first actuator, the first actuator including a first target and a first electromagnet that is spaced apart from the first target, the first target having a first target surface that generally faces the first electromagnet, the first electromagnet including a first measurement point that spaced apart a first physical gap g_1 from the first target surface, and a spaced apart second measurement point that is spaced apart a first functional gap $\bar{g}_1$ from the first target surface, g_1 being different than the $\bar{g}_1$; and

a control system that directs a first current to the first actuator based on g_1 and $\bar{g}_1$.

21. The stage assembly of claim 20 wherein the first electromagnet includes an E core and the first target includes an I core.

22. The stage assembly of claim 20 wherein the control system directs the first current to the first actuator based on the difference between g_1 and $\bar{g}_1$.

23. The stage assembly of claim 20 wherein the first current directed to the first actuator is calculated using the formula:

$$I_1 = \sqrt{\frac{[(g_o - \bar{x}) + a][(g_o - \bar{x}) + b]}{(g_o + a)(g_o + b)} \frac{F_1}{k}},$$

where $\mathbf{g_o}$ is the nominal operating E-I gap, a is a first parameter, b is a second parameter, k is an E-I force constant, F_1 is a first desired force to be

imposed on the stage, and $\bar{x}$ is the difference between a centerline of the stage and functional range midpoint of the stage.

24. The stage assembly of claim 20 wherein the mover assembly includes an attraction-only type second actuator that cooperates with the first actuator to move the stage, the second actuator including a second target and a second electromagnet that is spaced apart from the second target, the second target having a second target surface that generally faces the second electromagnet, the second electromagnet including a first measurement point that spaced apart a second physical gap g_2 from the second target surface, and a spaced apart second measurement point that is spaced apart a second functional gap $\bar{g}_2$ from the second target surface, g_2 being different than the $\bar{g}_2$, and wherein the control system directs the second current to the first actuator based on g_2 and $\bar{g}_2$.

25. The stage assembly of claim 24 wherein the first actuator imposes a first force on the stage that is at least partially opposed by a second force imposed on the stage by the second actuator.

26. The stage assembly of claim 24 wherein the first actuator and the second actuator form an actuator pair.

27. The stage assembly of claim 24 wherein the first electromagnet includes an E core and the first target includes an I core.

28. The stage assembly of claim 27 wherein the second electromagnet includes an E core and the second target includes an I core.

29. The stage assembly of claim 24 wherein the control system directs the second current to the second actuator based on the difference between the g_2 and $\bar{g}_2$.

30. The stage assembly of claim 24 wherein the first electromagnet is positioned at a first angle relative to the first target surface, and wherein the control system directs the first current to the first actuator based on the first angle.

31. The stage assembly of claim 30 wherein the second electromagnet is positioned at a second angle relative to the second target surface, wherein the control system directs a second current to the second actuator based on the second angle.

32. The stage assembly of claim 31 wherein the first angle is different than the second angle.

33. The stage assembly of claim 31 wherein the control system directs current to at least one of the actuators based on the difference between the first angle and the second angle.

34. The stage assembly of claim 31 wherein the control system directs current to each of the actuators based on the difference between the first angle and the second angle.

35. An exposure apparatus including an illumination source and the stage assembly of claim 20 positioned near the illumination source.

36. A device manufactured with the exposure apparatus according to claim 35.

37. A wafer on which an image has been formed by the exposure apparatus of claim 35.

38. A method for positioning a stage, the method comprising the steps of:

coupling a first actuator to the stage, the first actuator including a first electromagnet and a first target having a first target surface, the first electromagnet being positioned at a first angle having an absolute value greater than zero relative to the first target surface; and

directing current to the first actuator with a control system based on the first angle.

39. The method of claim 38 further comprising the step of coupling a second actuator to the stage, the second actuator including a second electromagnet and a second target having a second target surface, the second electromagnet being positioned at a second angle relative to the second target surface, the second actuator cooperating with the first actuator to move the stage.

40. The method of claim 39 further comprising the step of directing current to the second actuator with the control system based on the second angle.

41. The method of claim 39 wherein the one of the step of directing current to the first actuator and the step of directing current to the second actuator is based on the difference between the first angle and the second angle.

42. The method of claim 39 wherein the steps of directing current to the first actuator and directing current to the second actuator are each based on the difference between the first angle and the second angle.

43. The method of claim 39 wherein one of the actuators is an attraction-only type actuator.

44. A method for using an exposure apparatus to transfer an image onto a device, the method comprising the steps of:

retaining the device with a stage; and

positioning the stage utilizing the method of claim 38.

45. A method for making an object which utilizes the method for using the exposure apparatus of claim 44.

46. A method of making a wafer which utilizes the method for using the exposure apparatus of claim 44.

47. A method for positioning a stage, the method comprising the steps of:

coupling a first actuator to the stage, the first actuator including a first electromagnet and a first target having a first target surface that generally faces the first electromagnet, the first electromagnet including a first measurement point that spaced apart a first physical gap g_1 from the first target surface, and a spaced apart second measurement point that is spaced apart a first functional gap $\bar{g}_1$ from the first target surface, g_1 being different than the $\bar{g}_1$; and

directing current to the first actuator with a control system based on g_1 and $\bar{g}_1$.

48. The method of claim 47 further comprising the step of coupling a second actuator to the stage, the second actuator including a second electromagnet and a second target having a second target surface that generally faces the second electromagnet, the second electromagnet including a first measurement point that spaced apart a second physical gap g_2 from the second target surface, and a spaced apart second measurement point that is spaced apart a second functional gap $\bar{g}_2$ from the first target surface, g_2 being different than the $\bar{g}_2$.

49. The method of claim 48 further comprising the step of directing current to the second actuator with the control system based on g_2 and $\bar{g}_2$.

50. The method of claim 49 wherein one of the actuators is an attraction-only type actuator.

51. A method for using an exposure apparatus to transfer an image onto a device, the method comprising the steps of:

retaining the device with a stage; and

positioning the stage utilizing the method of claim 47.

52. A method for making an object which utilizes the method for using the exposure apparatus of claim 51.

53. A method of making a wafer which utilizes the method for using the exposure apparatus of claim 51.